



ADDENDUM NO. 01

Dated: December 29, 2014

1.01 General

Our Community School Modernization

DSA A# 03-115334

DSA File #19-36

Prepared for:

Our Community School

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Notice to bidders:

This addendum forms a part of the contract documents and modifies the original bidding documents dated **03/12/2014**. Acknowledge receipt of this addendum in the space provided on the bid form. Failure to do so may subject bidder to disqualification.

The Contract documents for Our Community School Modernization project are hereby modified. This Addendum consists of **1** specification sections and **10** drawing sheets.

1.02 Changes to Bid Documents

A. Specifications:

1. **ADD** Specification Section 27 51 16 – Public Address and Intercommunication System

B. Replaced Sheets:

1. **REPLACE** Drawing sheet E1.01 with attached. Changes as clouded and marked Delta 1
2. **ADD** Drawing sheet PA1.01 SYMBOL LIST, GENERAL NOTES AND ABBREVIATIONS
3. **ADD** Drawing sheet PA1.02 P.A. RISER DIAGRAM
4. **ADD** Drawing sheet PA1.03 P.A./I.C./CLOCK BLOCK DIAGRAM
5. **ADD** Drawing sheet PA1.04 DETAILS
6. **ADD** Drawing sheet PA2.01 P.A. SITE PLAN
7. **ADD** Drawing sheet PA2.21 P.A. PLANS, ELEMENTARY BUILDING 1 AND 2
8. **ADD** Drawing sheet PA2.31 P.A. PLANS, MIDDLE SCHOOL BUILDING AND K1 BUILDING
9. **ADD** Drawing sheet PA2.41 P.A. PLANS, MULTIPURPOSE BUILDING AND MUSIC BUILDING
10. **ADD** Drawing sheet PA2.51 P.A. PLANS, OFFICE BUILDING

END OF ADDENDUM NO. 01

SECTION 27 5116

PUBLIC ADDRESS AND INTERCOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Principal items of Work in this Section include but are not limited to:

1. Centralized racks, as indicated on the Drawings, containing a fully operational public address (PA) system, intercommunication system, and UPS. Features required include all-call paging, zone paging, class-tone activation, intercom access to individual speakers, phone to phone communications, radio and CD audio distribution, and classroom phone outside line access to 911. These features are accessible from the PBX, main PA phone, classroom phone or audio microphone. System shall also provide for interfacing with a master clock system for a class change signaling system, and with a Fire Alarm system for override of the tone signaling, PA audio, or both.
2. Conductors, conduits, and terminal strips, including interface cabling to PBX system, autonomous system overrides, Master Clock system and the Fire Alarm system.
3. Provide labor, engineering, design, testing, materials, supervision, tools, mounting hardware, cable management, software and components to provide a complete operable installation. The system shall be installed in compliance with project documents, applicable codes, manufacturer's published recommendations, and industry standards to deliver a system that meets standards of quality and functionality.
4. Provide services on Project site including specified connectivity for administration areas, classrooms, computer and science laboratories, libraries, auditoriums, multipurpose rooms, P.E. areas, quad area, other instructional areas, and work areas as indicated in Project Drawings.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 26 0500: Common Work Results for Electrical.
3. Section 26 0526: Grounding and Bonding.
4. Section 26 0513: Basic Electrical Materials and Methods.

5. Section 26 0519: Low Voltage Wires (600 Volt AC).
6. Section 26 2416: Panelboards and Signal Terminal Cabinets.
7. Section 26 5200: Emergency Power Systems.
8. Section 28 3100: Fire Detection and Alarm.
9. Section 27 5313: Clock and Program System.
10. Section 27 5127: Public Address Systems (Small Gyms, Multi-purpose Rooms)(ES).
11. Section 27 5128: Public Address Systems (Auditoriums, Performing Art, M-P Rooms)(MS and HS).
12. Section 27 5129: Public Address Systems (Gymnasiums).

C. Acronyms:

DTMF	Dual Tone Multiple Frequency
IC	Intercom
LCD	Liquid Crystal Display
OAR	Owner Authorized Representative
PA	Public Address
PBX	Private Branch Exchange
VFD	Vacuum Fluorescent Display
LED	Light Emitting Diode
SLC	Small Learning Community

1.02 SYSTEM REQUIREMENTS

A. Intercommunication System: System shall be a combined public address and intercommunication system with UPS.

1. Communication hardware shall be furnished with the capacity for internal communication between operator and selected classrooms. Normal and emergency alerts from classroom telephones to the main office shall be annunciated by an alerting tone, appear on a wall-mounted administrative display located where most office staff can view at the same time, and identify the calling room's extension. These alerts shall function as described by the manufacturer. Calls shall be displayed in the order in which they are received and the additional calls stored in memory. The main operator shall be able to answer calls in sequence or out of sequence. Caution office staff during training about using any queue-clearing commands without verifying the nature of each call. Dialed calls to classroom phones are initiated by ringing the classroom telephone. These phones shall have their ringer volume control locked in the maximum ring volume position. Dialed intercom calls to the classroom speaker are preannounced by an

alert tone and repetitively beep during the connection. If the classroom handset is lifted from its cradle and the conversation shall automatically transfer from the speaker to the classroom phone. Predetermination as to whether to ring the telephone or to permit talking over the speaker shall be user selectable when dialing. Signal switching for communication operations shall be accomplished by electronic methods.

2. Direct Dial Telephones: A direct-dial telephone system with electronic switching shall be furnished to accomplish the above description. The system control circuit shall be state-of-the-art design with modular plug-in printed circuit construction and advanced type technical mechanism. The central switching exchange shall utilize standard DTMF signaling for conformance with standard telephone practices.
3. Administrative Telephones: Administrative telephone communication system shall provide the following minimum requirements:
 - a. Administrative control center shall be a standard push-button dialing telephone complete with solid state pre-tuned tone oscillators identical to those employed by public telephone companies.
 - b. Central switching exchange shall be of the modular plug-in printed circuit board type, solid state sensing and logic, and shall also provide two-wire balance transmission complete with dial tone, automatic ringing and busy signal facilities.
 - c. Central switching exchange shall be furnished with facilities for a minimum of 8 unrestricted, simultaneous, private telephone conversations between:
 - 1) Administrative and administrative telephones
 - 2) Administrative and staff telephones
 - 3) Staff and staff telephones.
 - d. Capability as provided for direct dialing, private, two-way telephone communication between locations furnished with administrative telephone and staff telephone shall be provided.
 - e. Capability as provided for any administrative telephone to transfer a call from another administrative telephone or any staff (classroom) telephones to any other telephone.
 - f. Capabilities, as provided for the instantaneous distribution of emergency announcements simultaneously to all locations furnished with loudspeakers, by dialing a pre-determined code number.
 - g. Provisions for restricting access to the emergency announcements to certain administrative telephone. This

- shall be accomplished by the use of an authorized administrative telephone.
- h. Capabilities as provided for the origination of both normal and priority emergency calls from any staff station location shall be provided. Priority emergency calls shall take precedence over normal calls.
 - i. Facilities as provided for answering calls registered in the readout by pressing a single response button.
 - j. Provisions for instantaneous distribution of announcements to prescheduled groups of speakers from any location equipped with an administrative telephone.
 - k. Provide an all-cancel function from an administrative telephone to cancel all classroom annunciated calls. Note: During training session, caution users to verify the nature of each call-in before clearing the que.
 - l. Local diagnostic functions shall be provided to simplify maintenance.
 - m. The system shall incorporate non-volatile memory for programs, which shall not be affected by the loss of line voltage.
 - n. Central switch shall be designed to fit in any standard 19 inch rack-mounting. It shall be possible to remove individual circuit boards from the system for inspection and service without disturbing or disconnecting any exchange wiring. Analog PA shall remain operational when circuit boards are removed. Reasonable exceptions are permitted in the design phase (base effort).
DTMF programming: Administrative telephone shall be able to distribute announcements to each individual speaker or (intercom), zone page a group of speakers, or distribute all-call.
 - o. Audio level of the telephone intercommunication system shall be attained at sound levels sufficient to override typical ambient school noise levels and to provide for a satisfactory and serviceable system with a minimum of 70 dB isolation between PA and intercommunication signals.
 - p. Upon notification from the Contractor, the OAR shall contact the Telecommunications Branch of LAUSD to arrange for ordering of necessary additions to the voice system to coincide with the completion of the installation of the PA or Intercom system. Any work to the PBX system will be provided by the Owner to encompass both hardware or software additions and any necessary programming, and is outside of the scope of this specification. The Telecommunications Branch will

manage connections to the PBX voice system. Any vendor working on the telecommunications system must be pre-approved by the Telecommunications Branch prior to any work commencing.

- B. Public Address: Public address system reproduction shall provide the following minimum requirements:
1. Reproduction of speech shall be clear, high fidelity and with frequencies within range of system faithfully reproduced with no detectable noise, hum or distortion. The signal to noise ratio for the frequency range of 30 Hz to 20 kHz shall be a minimum of 90 dB.
 2. Reproduction shall be attained at sound levels sufficient to override noise levels typical for schools, to provide a thoroughly satisfactory and serviceable system with a minimum of 30 dB signal-to-noise ratio between public address program and background noise level of 65 to 70 dB.

1.03 SUBMITTALS

- A. Provide the following submittals:
1. Material list: Submit a complete material list for the materials and products of this section. Each submittal shall be bound and shall contain an index organized vertically by assembly and item number and horizontally by columns. The first assembly shall be the major head end equipment. The leftmost column shall be the item number; next shall be the description, followed by the applicable specification section number, followed by the specified item, which is followed by the submitted item. The rightmost column shall be for notes, which shall be used to reference the reason for submitting items other than as specified.
 2. Product Data: Include Product Data sheets or catalog cut sheets for items listed in index. Data shall be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data. Items shall be arranged in the same order as the index and if more than one item is indicated, the submitted items shall be highlighted or marked with an arrow. Product Data shall be sufficiently detailed to allow the Architect to review the product and to allow other trades to provide necessary coordination.
 3. Include in the Product Data list submission, copies of manufacturer certificates that the Contractor is an authorized distributor of the submitted manufacturer's products; and each member of the installation crew has been trained and certified in the installation of those products. Contractor shall submit proof that his or her

company has a service organization capable of responding within 24 hours of receipt of written notification and resolution within one day.

4. Contractor shall have completed at least five projects of equal scope to systems described herein and shall have been in the business of supplying and installing specified type of systems for at least five years.
5. Provide a letter from the Manufacturer assuring the availability of spare parts common to proposed system for a period no less than five years on components.

B. Shop Drawings: Shop Drawings shall indicate the following :

1. Drawn to scale, details of racks, consoles and cabinets with designations, elevations, dimensions, doors, barriers, mounting details, catalog number of locks, finishes and color. Provide a dimensioned detail of console nameplate including school name, address, and power load. Indicate manufacturer's part numbers for controls, switches, connectors and indicators. Provide a complete set of drawings of wiring diagram for each rack, instrument wiring and schematic diagrams of circuits of equipment.
2. Detailed drawings as to interfaces with equipment furnished by others including number of wires, termination requirements, input or output voltages, input or output signals and other required coordination items, items including point to point connection details for devices and equipment,
3. Provide a terminal block layout for the main public address terminal cabinet indicating the locations of terminal blocks for cables from the field, the public address rack, PBX, and as otherwise required. Indicate the typical lay down for each cable type and the number of blocks and space required. Include a front elevation indicating cabinet dimensions, make, location and capacity of equipment, size of gutters, type of mounting, finish, and catalog number of locks. General layout of internal devices, wiring drawings with wire numbers and device connections, vendor cut sheets of devices in enclosure and bill of materials listing description, manufacturer, part number, and quantity of items shall be included. Indicate terminal cabinet layouts for remote terminal cabinets as required.
4. Power load of public address system and UPS operational time calculations shall be separately calculated and included with Shop Drawing submittal. Provide cabling and conduit from rack-mounted UPS to one of the MDF cabinets. Notify OAR to contact

ITD for SNMP connection from the UPS to the LAUSD network when system is ready.

5. Shop drawings shall indicate equipment locations, wiring and schematics, details, panel configurations, sizes and a point-to-point wiring diagram of circuits. Shop drawings shall indicate interfaces to equipment furnished by others, identifying numbers of wires, termination requirements, input or output voltages, input or output signals and other pertinent details. Responsibility for each end of interfaces shall be noted on shop drawings.
6. Submit Drawings prepared, signed, and sealed by structural engineer licensed in the State of California. Details shall be provided indicating the proposed means of support and attachment of wall and floor mounted racks. Calculations shall be based on the maximum load rating of the cabinet by the manufacturer per CBC seismic environment requirements, not the weight at time of occupancy.
7. Provide Shop Drawings, in the same size as the Record Drawings. Shop Drawings shall be prepared in the latest version of AutoCad with three – CD-ROM electronic copies submitted along with one set of full sized Shop Drawings.
8. Installation and coordination drawings for items in other sections shall be included with submittal of Shop Drawings. Submit blue line copies and one reproducible copy of installation and coordination drawings.

- C. Sample Materials: Provide samples of material and equipment as required by the Architect. If samples are requested, they shall be submitted within ten days from the date of request.

1.04 CODES AND STANDARDS

- A. Complete installation shall meet or exceed the latest edition of following standards.
1. EIA/TIA-568: Commercial building telecommunications wiring standard.
 2. EIA/TIA-569: Commercial building standard for telecommunications pathways and spaces.
 3. EIA/TIA-606: Administration standard for telecommunications infrastructure of commercial buildings.
 4. EIA/TIA-607: Commercial building grounding and bonding requirements for telecommunications.
 5. CCR Part 2 - California Building Code (CBC)

6. CCR Part 3 - California Electrical Code. (CEC)
7. ANSI, ASTM, UL, NEMA, IEEE and FCC standards as applicable.
8. BICSI Telecommunications Distribution Methods Manual, current edition.

1.05 SYSTEM DESCRIPTION

- A. The Public Address or Intercommunications system shall be comprised of two separate inter-operating systems which shall provide redundant means of performing an all-call public address function and class tone distribution. Besides all-call and telephone functions, only the software-programmable system provides zone paging, zoned class-change tone distribution, two-way loudspeaker intercommunication, AM/FM radio-CD audio distribution and tone choices. The analog PA system only provides an emergency all-speaker public address from a main office microphone with feedback elimination circuitry, and an all-speaker class tone distribution activated by a service switch. Both public addresses systems shall be furnished with totally separate active electronic components. It shall be possible to remove power from components in one system while retaining the functionality of the other system. Both systems shall share a common, rack-mounted UPS with a SNMP, centrally monitored, network connection. Systems not providing public address and class tone distribution redundancy are not permitted
 1. As a minimum a two hundred and fifty (250) watt public address amplifier shall be provided for the analog PA system. The total wattage load of all the speakers in the system shall be measured to determine if additional two hundred and fifty (250) watts or higher wattage public address amplifiers are needed. The spare wattage capacity for each public address system amplifier shall be a minimum of 33 percent of the total wattage load for each amplifier at the time of occupancy.
 2. Provide antifeedback circuitry or rack mounted feedback eliminator in PA rack. No feedback shall be detected from the fixed volume, always-hot microphone.
 3. Combine networks shall be used to convert stereo auxiliary inputs unless the dual input aux input of a preamp module provides this.
 4. A microphone shall be installed in the main office in a lockable fold-up wall cabinet which also contains an Am/Fm/single CD player. This microphone shall be “always hot” – activating a microphone switch will connect it directly to the analog public address system, permitting an emergency all-call announcement to

be performed. A volume control for this microphone may be provided only if the minimum setting is still audible.

5. A public address administrative telephone shall also be installed in the main the office, in each SLC, and in each Academy on the school site and terminate in the PA rack. Each shall use power originating from the PA UPS so they will be operational during a building power outage. The paging trunk outputs from the PBX shall be connected to unassigned phone ports of the programmable PA system, with PA ports programmed high enough for all-call, and labeled.
6. Program-All distribution through all loudspeakers, outdoor speakers, auditorium system speakers, gymnasium speakers, and multi-purpose room speakers through a relay control. Program-All shall furnish full priority over switching between amplifier and speakers of central control system, except as specified. Program-All shall obtain signal sources as selected.
7. For each autonomous system, a selector switch on the custom control panel shall be provided to automatically override autonomous system speakers.
8. Automatic class change signaling system shall include manual controls to select program and to do all call. A panel mounted in the P.A. rack shall include at a minimum a selector switch to provide selection of three programs and a separate switch to do all call. The number of class change signaling systems shall be determined by the number of small learning communities or other academies at the site. The Public Address and Intercommunication system shall be able to support as many class change signaling needed, by providing a custom panel which can provide additional signal zones and tones. The design shall include the use of additional signal generators in order to provide different tone signals and the selection of three programs and a separate switch to do all call for each of the additional Learning Communities or other academies. The class change signaling selector switches shall be wired to the clock program controller for selection of one of three programs for each independent Learning Community or Academy. The selected program shall be distributed over the microprocessor based loud speaking intercom and P.A. system. At school sites where there are no independent Learning Communities or Academies, and a master clock remote input panel zone selector has been installed, typically in the main office, the automatic class change signaling system control on the PA rack shall be bypassed.

- a. In Middle and High schools, the class change signaling system shall be programmed to include dressing and cleanup tones for gymnasiums and shop zones.
- B. In Middle and High schools, the master clock will transmit three contact closures from three separate relays per schedule. The other system shall be a microprocessor based, DTMF tone controlled modular loud speaking intercom and public address system. The intercommunication system shall provide communication between classroom telephones, speakers, administrative phones and PABX system and shall operate in conjunction with Public Address equipment. The system shall provide the following features and capabilities:
 1. The system shall be available in a rack mounted card cage configuration with a printed circuit backplane or a card shelf with a modular shelf assembly with through plug-in circuit cards. The processor card, speaker control cards, telephone control cards and PBX telephone interface cards shall plug into card connectors on the backplane or into a modular shelf assembly with through plug-in circuit cards.
 2. Speaker cards shall be installed in card cages or card shelves. Each speaker or telephone card can control sixteen or twenty-four speaker circuits depending on the system. Provide speaker and telephone cards for each switch bank as needed.
 3. DTMF tone capable cards shall be installed in any one-card cage or modular shelf. Each card can control sixteen to twenty-four call stations, DTMF telephones or display phones in any combination. Provide one station card for the first switch bank to allow connection of the system control display phone. Provide additional station cards for emergency call buttons or phones.
 4. One relay card or more per switch bank and one or more analog cards are required on switch bank. These relay cards are connected to the printed circuit backplane directly or with ribbon cables. The relays in the relay card allow the system to seize control of speakers and station circuits as required. Control voltage to the relays may be interrupted to drop out system functions and give the intercom or program control panel and associated equipment priority. The relay card is the only item common to both systems. It contains no active circuitry. Each relay card has provisions for attachment of an external power amplifier if required.
 5. A power or program panel shall be provided to supply the manufacturer's specified power for the analog speaker cards, telephone cards and for other components in the system. The power supply of the DTMF controlled system shall be independent

of the switch bank based Public Address and Intercom System. It shall also be provided with a three channel auxiliary program input chassis into which three modules of various types may be installed. These modules shall include microphone pre-amplifiers; transformer couples line pre-amplifiers, microphone, and telephone paging modules, a multiple tone generator, and a FM tuner module. Three outputs from the auxiliary program input chassis shall be connected to the backplane where their programs may be selected for distribution by the microprocessor-based system.

6. One DTMF based control console administrative telephone with an LCD display shall be installed in the main office in each SLC and in each Academy. It shall be possible to program and control microprocessor-based equipment with this control console, if this feature is provided by the manufacturer. It shall also be possible to make zone pages and all call pages to assign programs to any or all speakers, to assign individual speakers to time and page zones and to make loud speaking intercom calls.
7. An external 250-watt power amplifier shall be provided for the last switch bank, or of the last 2 switch banks if required.
8. Telephones: System shall be ADA compliant and utilize DTMF based, 2554 type wall mounted or 2500 type desk phones. Wall phones shall be fully modular. System shall automatically transfer an intercom call made to a loudspeaker to the associated intercom telephone when the phone is taken off hook.
9. Emergency Calls: System shall possess an emergency call feature, which may be activated by either one of the three following methods: dialing * * and hanging up, by four or more flash-hooks within a two second interval or lift the phone off the hook and wait for a configured length of time (typically 15 or 30 seconds). Emergency calls shall appear at the top of the answer queue and shall ring with a distinctive ring cadence on the designated administrative station or wall display unit.
10. Wall Display Unit: System shall be furnished with only one wall display unit, which displays the time and call-in information. Emergency calls take priority and flash "HELP", "E" or display station number. Information shall be displayed on LED, VFD, or LCD segments and shall be accompanied by distinct tones for emergency, normal, and call waiting originations. Tone level shall be adjustable. The information from telephones installed in the Public Address system shall be displayed on only one wall display installed at the main office. (In some systems the emergency call will not appear until the display phone line is no longer being used).

11. Privacy Feature: System shall have a privacy feature, which renders impossible unannounced monitoring of intercom conversations from the PA or IC rack, administrative telephones or other intercom station.
12. Channels: A minimum of eight channels of intercommunication shall be provided together with the Public Address System.
13. Loop Start Trunk Ports: System shall provide intercom system dial tone for loop start trunk ports from the PABX via Intercom station ports or telephone adapter modules. PABX based DTMF phones shall hear a beep and then receive PA or IC dial tone. It shall be possible to assign various levels of intercom capability to these ports via intercom system programming. These ports shall allow calls from the PABX to individual intercom stations or to access page functions. The Intercom station ports or telephone adapter modules shall have transformer based isolation circuits to protect both PA or IC and PABX from harmful transient signals that may be present in the lines. Each Intercom station port or telephone adapter module shall use optical isolators to detect the 90 volt ring signal from PABX station ports. In middle schools and high schools, a minimum of four loop start trunk ports from the PABX via intercom station ports or telephone adapter modules, shall be connected. Two such circuits shall be connected for primary centers and elementary schools.
14. Interface Modules: System shall be furnished with a telephone interface module to provide up to eight DTMF based telephone ports, which are compatible with 2500 Series, PABX station ports. System shall be provided to allow up to eight simultaneous calls from the intercom system to PABX connected instruments, or to outside lines. These ports shall allow calls from the intercom system to the PABX and shall appear transparent to the PABX. Each port requires one telephone cable pair. Four such circuits shall be connected to the PABX at time of installation. Circular or linear hunt shall not interfere with PABX to PA or IC interface.
15. Intercoms: System shall provide 2554 or 2500 series telephone in rooms.
16. Provision shall be furnished to connect up to six separate time zone schedule controllers to the microprocessor-controlled system. When a contact closure is provided by a remote time controller, speakers assigned to the time zone will sound a passing tone of standard tone and duration.
17. The Public Address System shall be configured in such a way as to prevent tones initiated automatically or manually from the Public

Address console and manually from any telephone when the Fire Alarm Control Panel is in alarm. See standard detail SD 5.14 for Fire Alarm Control Panel to Public Address System physical interface requirements. An additional separate circuit shall also be required to inhibit loudspeaker audio outputs when another separate relay contact closure occurs from the Fire Alarm system. This second closure shall also require activating activation of the muting relay circuits to autonomous PA systems.

18. Central Intercom Switch: Central intercom switch shall fit in standard 19-inch mounting rack. Circuit boards shall be removable from system for inspection and service without disturbing or disconnecting exchange wiring. Units and electronics switches shall be engineered to fit in one 65-inch rack (exchange system and PA system).

1.06 QUALITY ASSURANCE

- A. Work shall conform to CCR, Title 24 Part 3, Basic Electrical Regulation and National Electrical Code, latest edition.
- B. Only a qualified Contractor holding licenses required by legally constituted authorities having jurisdiction over the work, shall do the work.
- C. Persons skilled in trade represented by work, and in accordance with applicable building codes, shall install system in accordance with best trade practice.
- D. Work shall be performed by a Contractor that has completed at least five school systems of equal scope to system described herein and shall have been engaged in business of supplying and installing specified type of systems for at least five years. Contractor shall maintain a fully equipped service organization capable of furnishing repair service to equipment
- E. Use adequate numbers of skilled workmen who are currently manufacturer certified, thoroughly trained and experienced on the necessary crafts and completely familiar with the specified requirements and methods needed for the proper performance of the work.
- F. Coordinate cable runs, and rack equipment locations with the Owner's Authorized Representative during the initial design of the cable installation. Contractor and OAR must agree as to the final location of devices and the cable plant design.
- G. Provide technicians and tools required to participate in Owners Quality Assurance Testing as detailed in Attachment "A" of this specification.
 1. Items on check list of Attachment "A" will be examined as a minimum at the Public Address Head End, terminal cabinets, ground vaults and classrooms. Should the examination show

deficiencies related to items in the checklist, Owners acceptance testing will be discontinued until corrections have been made. When the Contractor has completed the corrections, a subsequent Quality Assurance test shall be initiated. This procedure is in addition to the system functionality testing required in Article 3.03 below.

1.07 WARRANTY

- A. Warranty that work executed and materials furnished shall be free from defects in materials and workmanship for a minimum period of three years from date of installation acceptance, date of Contract Completion, excluding specific items of work that require a warranty of a greater period as set forth in this Specification. In the event a manufacturer's warranty is longer than three years, the manufacturer's warranty shall be the warranty period. Immediately upon receipt of written notice from the Owner, repair or replace at no expense to the Owner, defective material or work that may be discovered before final acceptance of work or within warranty period; any material or work damaged thereby; and adjacent material or work that may be displaced in repair or replacement. Examination of or failure to examine work by the Owner shall not relieve Contractor from these obligations.
- B. Equipment or materials failure rates of ten percent or more during the warranty period:
 - 1. District shall monitor the performance and reliability of the installed base of Equipment and Materials installed in this Contract. Any deficiencies or malfunctions will be referred to the Contractor for repairs or equipment replacement.
- C. If the District detects a defect within a warranty period as defined here in, it shall notify the Contractor Representative in writing ("Notice of Defect"). Make available and provide the District with the telephone number of a fax machine to receive Notices of Defect. This fax machine shall be available to receive faxes 24 hours per day seven days per week, including weekends and holidays
- D. Upon receipt of written notice from the District of any failure or defect ("Defect") in any such Equipment or Work, the Contractor shall diligently perform work necessary to determine the cause thereof, and the time necessary to remedy the Defect, and shall propose in writing to the District how and in what manner it will remedy the Defect. If the District determines that the proposal complies with the terms of the Contract, it shall authorize Contractor to proceed to redesign, repair, or replace the defective or failed Equipment or Work within the agreed time period.

- E. In determining the cause of the Defect, perform such investigations and tests as may be required to determine the cause, and to verify that such redesign, repairs, and replacements comply with the requirements of the Contract Document. Cost associated with such investigation, redesign, repair, replacement, and testing, including, but not limited to, the removal, replacement, and reinstallation of equipment and materials necessary to gain access to defective Equipment, shall be borne by the Contractor. Should the Contractor fail to promptly make the necessary investigations, redesign, repair, replacement, and test, the District may perform or cause to be performed the same at the Contractor's expense.
- F. Contractor will warrant the redesigned, repaired, or replaced Equipment against defective design, materials, and workmanship for the remainder of the warranty period or a period of three years from and after the date of acceptance of the redesigned, repaired or replaced Equipment thereof, whichever occurs later.
- G. Contractor shall be liable for the satisfaction and full performance of the warranties as set forth herein.
- H. Warranties are deemed and acknowledged to explicitly extend to the future performance of the Equipment warranted.
- I. The rights and remedies provided for herein are cumulative, and shall not be exclusive and are in addition to any other rights and remedies provided by law, whether in contract or tort, or under this Contract.
- J. Contractor is deemed and acknowledged to be a merchant with respect to components and replacement parts furnished pursuant hereto, and the District is acknowledged not to be a merchant with respect thereto.
- K. In the event any Supplier or manufacturer offers any extended warranty not specified herein, state the terms of such warranty or warranties in writing and extend the same to the District without additional cost to the District.
- L. Warranties and guarantees of Suppliers of any tier and Manufacturers, whether expressed or implied, are deemed to be made for the benefit of the District regardless of whether stated as such, and Contractor shall enforce such warranties and guarantees for the benefit of the District.
- M. Include a letter signed by a corporate officer, partner, or owner of the contracting company describing their service organization, its capabilities and commitment to servicing the warranty on work executed and materials furnished.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Public Address Intercommunications system shall be Bogen Multicom 2000/MCP-35A (modified), Bogen Quantum Multicom 2000/MCP-3A (modified), Dukane StarCall/(with or without 3200 using alternate audio card), Rauland Telecenter V/MCZ-300 (modified) or Rauland Telecenter VI/MCZ-300 (modified), or equal. In small site projects approved by the ITD PMO office, small paging systems (Bogen PCM2000 or equal) may be integrated with the site PBX.
1. A Public Address and Intercommunication system shall not be expanded past the stations or ports capacity stated in the manufacturer's product specifications.
 2. The Bogen Quantum Multicom 2000/MCP-35A is permitted for sites with any number of stations. Interconnecting two card cages, each with a Quantum processor card by use of an Ethernet cable is permissible. Use of SIP1 classroom phones are not permitted.
 3. Voice over IP systems or Voice over IP integrated design systems shall not be accepted except in projects approved by the ITD PMO office.. Voice over IP designs to increase the station capacity of any public address intercommunications system shall not be accepted. Manufacturer designed Ethernet interconnections between card cages are permissible if evaluated by ITD.

2.02 SYSTEM EQUIPMENT

- A. System Equipment Rack: The following specifications apply to equipment furnished with the Public Address or Intercommunications System.
1. The equipment rack shall provide a minimum of 77 inches of vertical panel space to accommodate 19-inch panels having 1 ¼-inch by ½ inch mounting spacing. The rack shall be 22 3/8-inch wide by 18 ½-inch deep by 81 3/8-inch high, with louvers and knockout openings on the sides and rear. There shall be a rear door having slip-joint hinges for easy removal without the use of tools. The rack shall be constructed of 16-gage steel. The rack shall be finished in black enamel Cabinet shall be constructed with mounting rails tapped for No. 10-32 screws on EIA spacing front and rear. Cabinet shall be tested and certified to the seismic specifications set forth by NEBS Telcordia Technologies GR-63-CORE. Calculations for seismic bracing shall be based on the maximum load rating of the cabinet by the manufacturer in a CBC regulated environment, not the weight at time of occupancy. Rack shall be UL listed.

B. Central Card Cage or Shelf Assembly:

1. Central Processor Card

Contains the system software that controls system features, functions, connections, audio, data and configuration for the DTMF controlled part of the Public Address and Intercommunication System.

2. Intercom Telephone Cards or Speaker Cards:

An intercom telephone card or speaker card shall be provided for PA or IC ports for which intercom telephones are provided or for which intercom access is required.

3. Interface PA or IC to PBX

System shall be equipped to provide eight simultaneous calls from the intercom system to a PBX., Direct connection to outside lines in the absence of a PBX, if software restricted to 911 only, may be permitted on a case by case basis with permission from the Telecommunication department.

4. Interface PBX to PA or IC

Provide Intercom station ports or telephone adapter modules to allow four loop start trunks from PBX to obtain access to intercom system dialing capabilities.

C. Administrative Display Telephone:

1. Telephones shall be designed to work with intercom system, shall utilize DTMF dialing and shall be furnished with the following features:

a. Function keys and display: Telephone shall be furnished with a standard 12-button keypad and LCD display for full alphanumeric menu-driven operation.

b. Telephone shall display station numbers with priority levels for incoming calls. Unique ring tones and flashing message or station number on display shall distinguish emergency calls from other calls.

c. Telephone shall provide two-way, hands-free speaker operation and private handset operation. Handset shall be fully modular with a dynamic receiver and transmitter compatible with adjustable volume handset for the hearing impaired.

D. Intercom Instruments:

1. Wall-mounted: Intercom instrument shall be fully modular Series 2554 telephone instrument with industry standard DTMF keypad and 90 volt, 20 Hz compatible bell ringer. Unit color shall be cocoa brown. Unit shall be mounted with screws through the base; connections shall be provided directly to the network card. The handset cord shall be fully modular.
2. Desk-mounted: Intercom instrument shall be fully modular Series 2500 telephone instrument with industry standard DTMF keypad and 90 volt, 20 Hz bell ringer. Unit color shall be cocoa brown.
3. The bell ringer loudness control for both classroom wall-mounted and classroom desk-mounted sets shall be fixed to the loud position permanently. The loudness control for the ringer shall not be adjustable.

E. Ring Adapter Cards:

1. A ring adapter card shall be provided at PA or IC ports for which intercom telephones are required. This card shall provide standard 90 volt, 20Hz cycle to the telephone instruments to allow industry standard 2500 Series desk and 2554 Series wall telephones to be furnished.

F. Wall Display Unit:

One wall display unit shall be provided and shall display time of day, station number and call priority. Unit shall provide unique ring tones to distinguish emergency calls from non-emergency calls. Emergency calls shall move immediately to the top of the queue and shall be accompanied by flashing "HELP", "E" message or the classroom extension number. Alternative characteristics are permissible if they follow the manufacturer's published description.

G. Intercom or Program Distribution Control Panel:

1. The analog PA system shall be modified versions of the Bogen Model MCP-35A, Rauland MCZ-300 or Dukane 3200 without switchbanks. The intercom function shall be disabled due the absence of switch banks. Remove or cover intercom operational labeling that has been deactivated.
2. The control panel shall be solid-state and designated for continuous duty service on line voltages of 120 volts, 60 Hz AC.
3. It shall be furnished with two separate amplifiers. The program amplifiers shall provide a minimum of 35 watts RMS at less than one percent distortion at rated power and bandwidth. The frequency response shall be within + one, -3dB from 80 Hz to 15 KHz. The intercom amplifier shall be furnished with an output rating of 15 watts RMS; frequency response shall be shaped for

maximum intelligibility. Both amplifiers shall provide balanced 25-volt line output.

4. It shall be furnished with inputs for two Lo-Z balanced microphones, one Hi-Z unbalanced auxiliary input, telephone paging accessories and booster amplifier. Terminals shall be provided to activate the time signal feature and Telco page feature.
5. It shall provide controls necessary for two-way intercom communication with any classrooms, communication with any classroom, distribution of general announcements or program material to classrooms, and transmission of emergency announcement to classrooms. Provisions shall be included to permit emergency paging from a remote telephone, or microphone, which shall capture system priority and override all functions except for the emergency page feature.

H. AM-FM Tuner and CDPlayer.

I. CD Player/Changer

J. Power Amplifier

1. The Power amplifier shall be a solid-state amplifier with transformer isolated output for 25V systems. Direct coupled amplifiers shall not be accepted.
2. The amplifier shall provide an audio output of 250 watts rms continuous or value as determined by design calculation. The rated output shall be obtained with an input that is not greater than 500m V(rms).
3. The amplifier shall provide either balanced or unbalanced constant-voltage outputs of 25 volts and 70 volts, plus four and eight ohm balanced or unbalanced outputs. Output regulation shall be within 2dB from no load to full load.
4. The amplifier shall incorporate electronic shutdown circuitry, which shall activate whenever an overload or short occurs on the output of the amplifier. A front panel overload shutdown LED shall illuminate to indicate the discontinuance of power output once the cause of the shutdown condition had been removed.
5. The amplifier shall be furnished with thermostatic control to prevent operation at excessive ambient temperatures. The amplifier also shall include electronic overload limiting and short-circuit protection and shall be properly fused and rated for continuous operation.
6. The standard amplifier shall be furnished with an EIA 19-inch front panel suitable for rack mounting.

ANTENNA AND GROUNDING

A. Antenna and Accessories:

1. FM Antenna: Furnish and install a Blonder Tongue BTY-2-FM, or equal, all-direction FM dipole antenna on roof at indicated location. Lead-in cable shall be 75-ohm weatherproof coaxial type, equipped with necessary weatherproof matching transformer at each end. Cable shall be Belden 8241, or equal. Provide a weatherproof surge protector, with # 6 AWG grounding conductor to a grounding electrode. The grounding conductor shall be bonded to the mast and surge protector
2. AM Antenna: Furnish and install a whip type AM antenna. Antenna shall be insulated from ground. Guy AM antenna whip from mast with an insulated standoff. If signal strength is not adequate from such an antenna, provide and install a 30 foot length of hard drawn #12 copper wire between new roof antenna masts. Lead-in wire shall be 75 ohm coaxial cable, Belden 8241, or equal, furnished with necessary matching transformers at each end. Provide a weatherproof surge protector, or equal with # 6 AWG grounding conductor to a grounding electrode. The grounding conductor shall be bonded to the mast and surge protector.
3. Provide and install an AM/FM antenna coupler in outdoor housing mounted on antenna mast.
4. Provide and install an antenna mast on roof of closest building to the PA rack or as indicated on Drawings. Mast shall be 1-1/4 inch galvanized steel and shall be secured to roof joists with steel straps specifically manufactured for installation.
5. Provide and install 3/4 inch antenna conduit from PA console to antenna. Provide and install a weather head, roof flashing.

B. Grounding:

1. Wiring enclosures, terminal cabinets, outlets, frames of cabinet racks and other enclosures shall be grounded in accordance with requirements of California Electrical Code and as specified.
2. Chassis of amplifiers, power supplies, and other electronic power equipment shall be grounded by bonding to control cabinet.
3. Housing and grips of microphone and conductive housings and other equipment shall be grounded by means of grounding wire or shield in cord or cable furnished for equipment connections.
4. Circuits shall be grounded as recommended by manufacturer of equipment to which they are connected unless otherwise specified.

5. Furnish, install and bond a #6 AWG, green grounding wire from the main public address terminal cabinet to console equipment rack main terminal. Frame of console and circuit wiring requiring grounding shall be grounded to ground system at equipment rack main terminal. Loudspeaker circuits and communication circuits shall operate balanced to ground.

2.04 SPEAKERS AND ACCESSORIES

A. Loudspeakers:

1. Each loudspeaker mechanism shall be mounted in flush back-box or surface baffle as indicated on Drawings and as specified.
2. Frequency response of loudspeakers shall be considered to be frequency response of speaker together with its associated line transformer. Power rating of each speaker shall be its capacity to reproduce, with satisfactory frequency response and performance, at rating level specified. Adjust power delivered to each speaker, as necessary, to insure a satisfactory sound level, with reproduction of good quality, in each of locations where speakers are installed.
3. Speaker mechanism shall be eight inch diameter, cone type radiating element, 9,500 gauss per square inch Alnico 5 magnet, and moving coil type. Cone shall be seamless. Sensitivity shall be a minimum of 94 dB SPL per meter at one watt. Power handling capacity shall be a minimum of 15 watts RMS. Magnet shall have a minimum weight of ten ounces. Nominal frequency response shall be 80 to 8,000 Hz. Speakers shall be Quam 8C10PAOT, or equal, unless otherwise specified.
4. Loudspeaker Volume Controls: Loudspeaker volume controls shall be "L-Pad" attenuators of suitable impedance or autotransformer attenuators with 10 steps (and off). "T-Pad" or potentiometer shall not be accepted as a loudspeaker volume control. Furnish, install and connect volume controls on loudspeakers located in areas other than classrooms. For wall-mounted baffles, install control within baffle with shaft extending through bottom. For ceiling-mounted speakers, install volume control on wall in a convenient location. Provide shaft with round knob and dial-plate to indicate position of setting. Loudspeaker volume controls shall be installed only where indicated on Drawings.

B. Impedance Matching:

1. Speakers: Each loudspeaker shall be provided with a line transformer having taps as necessary for proper matching and proportioning power to speaker. Frequency response of each transformer shall be within 3dB from 70 to 10,000 Hz. Minimum

power handling capacity of each transformer shall be a minimum of 2.5 watts. Transformers shall be Triad S-79Z, or equal.

2. Line:

Each line-matching transformer shall be furnished with similar frequency response as speaker transformer, and be shielded and equal to TC-LS-34.

a. Speaker line impedances shall be selected as necessary to limit distortion to a minimum. Line loss to any speaker operating at normal input shall not exceed 1 dB. Speaker matching transformer shall be connected to provide a satisfactory division of power among speakers. Sum of power distributed to speakers connected to any one-power amplifier shall not exceed 66 percent of amplifier power output rating specified herein.

b. Impedance and signal level matching is required.

C. Types of Speakers:

1. Type "A" Flush Mounted Speakers:

a. Speaker baffle shall be a vandal-proof, round, flush-mount Quam model BR8VP, or equal. It shall be constructed of #14 gage carbon steel with a tensile strength of at least 55,000 psi. Finish shall be white baked powdered epoxy, virtually scratch and mar resistant. Baffle shall incorporate a sub-plate fabricated from heavy-gage steel that shall provide an interlocking lattice grid pattern to protect speaker from tampering and vandalism. Protective sub-plate shall be acoustically transparent. Sub-plate and speaker shall be secured by means of casehardened square-shanked carriage bolts. Baffle shall mount in a Quam ERD-8NS backbox by means of tamper-proof hardware provided.

b. Backbox shall be a Quam ERD-8NS, or equal, recessed round enclosure designed to accommodate 8-inch speaker or baffle assemblies. It shall be made of one-piece #22 gage drawn steel with a rust-inhibiting coating, and an interior treated with a fire-retardant resonance damping material. Bottom inside of backbox shall have affixed a 9-inch pad of 3/8 inch thick acoustic foam to provide additional resonance and vibration control. Four combination conduit knockouts 1/2 inch and 3/4 inch shall be deeply scored, but not through, to preserve leak-free integrity of enclosure in air plenum

installation. These combination knockouts shall be spaced 90 degrees apart.

- c. Provide spanner type tamperproof screws to secure grille to backbox.

2. Type "B" Surface-Mounted Speakers:

- a. Type "B" surface-mounted speakers shall be a Quam VP2, or equal. Speaker shall be quality 8-inch type, complete with a 25V/70V line matching transformer tapped at 1/2, 1, and 2 watts. Speaker frequency response shall be 50 to 15,000 Hz, with an axial sensitivity of 96dB per meter with one watt input. Power rating shall be 15 watts. The speaker shall incorporate a 10 ounce ceramic magnet; the voice coil shall be 3/4 inch in diameter and shall have an impedance of 8 ohms.
- b. Speaker or transformer assembly shall be mounted in a wall-mount, sloped baffle constructed of special heavy-gage cold-rolled steel which shall be virtually impervious to direct blows: steel back mounting plate shall be pre-punched to fit any standard outlet box and shall be so designed as to make it practically impossible to gain access to speaker. Type 6-32 tamperproof machine screws shall be used to attach baffle to steel mounting plate. Mounting plate shall be installed so that baffle is perfectly level.
- c. Entire assembly shall measure 13 3/4-inch high, 10 7/16-inch wide, 5 3/4-inch maximum depth, and 4 3/8-inch minimum depth. Baffle shall be finished in semi-gloss white epoxy. Complete hardware shall be provided with speaker assembly.

3. Horn Loudspeakers:

- a. Type "C" Horn Loudspeakers: Horn loudspeakers shall be weatherproof vandal-proof type. Speakers shall be Atlas model APF15T with Soundolier VP410S baffle and VPA-APF adaptor, or equal. Furnish and install weatherproof cover plates with plastic bushed holes in plates to admit waterproof cable to speaker in drip loops. Each horn speaker assembly shall be mounted in a vandal-proof steel enclosure. Submit a drawing of assembly to the Architect for review. Type "C" horn loudspeakers shall be furnished for outdoor areas such as lunch shelters, arcades, walkways, etcetera. Note that sound travel distance for this horn is less than the C1 horn due to its higher low frequency cutoff point.

- b. Type "C1" Horn Loudspeakers: Horn Loudspeakers shall be weatherproof and vandal-proof types. Speakers shall be Atlas Model APC-30, or equal. Furnish and install weatherproof cover plates with plastic bushed holes in plates to admit weatherproof cable to speaker in drip loops. Each speaker assembly shall be mounted in a vandal-proof steel enclosure. An optional access door may be provided if secured with fasteners that require a tool to remove, or secured with a Cat-60 padlock. The access door, if provided, shall be large enough to remove the horn driver, change taps, adjust the tilt of the horn, or remove and test the cabling. Submit a drawing of assembly to the Architect for review. Type "C1" horn loudspeakers shall be furnished for large outdoor areas such as playgrounds, physical education fields, athletic fields, etcetera.

2.05 ELECTRONIC RECEPTACLES

- A. Microphone receptacles shall be Cannon XLR or SLR Series, or equal. Receptacles shall be furnished with mounting brackets for floor boxes, Sierra, or equal, .040 inch stainless steel plates, unless noted otherwise on Drawings. Each plate shall be engraved with its receptacle function in 3/16-inch high letters filled with black paint. Receptacles shall conform to following:

<u>Type</u>	<u>Description</u>	<u>Model</u>
"A"	Single Microphone male	LR-3-14, on a one-gang plate receptacle wall mounting
"B"	Single microphone male	LR-3-14N, with a CA015-0094-000, receptacle floor mounting yoke.

2.06 CONDUCTOR OR CABLES

- A. Cable for overriding Autonomous PA system shall be one twisted pair, #18 conductor; West Penn #CL2 293, or equal. For outdoor and underground applications, West Penn Wire Corp. # AQ 293 shall be furnished. This stranded wire shall not terminate on 66 or 110 blocks. Install and use screw terminal strips adjacent to the punch blocks.
- B. Cables for microphone and other input sources and speakers shall comprise one twisted pair of #22 gage solid copper conductors; polyethylene shielded with an aluminum foil-mylar shield, a #22 gage stranded tinned copper drain wire and polyvinyl jacket. Cable shall be West Penn Wire Corp. CL2 290, or equal. For outdoor and underground applications, West Penn Wire Corp. # AQC 291 shall be furnished.

- C. Two-pair #22 gage, fully annealed copper wire. One twisted pair (black and red) conductors shall be shielded and the other twisted pair (green and white) shall be unshielded. Both pairs shall be under one jacket. This cable is to be provided for combination telephone and public address Work. Furnish shielded pair for speaker lines. Mohawk #1772, West Penn CL2 #355, or equal. For outdoor and underground applications, West Penn Wire Corp. # AQC 355 shall be furnished.
- D. Jumper wire or cross connect wire shall consist of solid copper conductors, insulated with polyvinyl chloride and color coded, #22 gage, Brand-Rex, or equal.
- E. Cable for types C and C-1 speakers shall be West Penn CL2, AQ or AQC, as required, 289, 290, 291, 292, 293, 294, 295 or 296. Cable provided shall be selected based on calculation of the cable gage required to produce no more than a 1 dB drop in voltage at the load, given the load at which the speaker is tapped and the distance the cable is run. At the main PA termination field or at any other termination field, do not use the 66 punch blocks for any stranded wire. Install and use screw terminal blocks adjacent to the 66 blocks or remove one of the 66 blocks if adequate room is not otherwise available for these screw terminal blocks.
- F. Interface cable from clock controller to the Public Address rack shall provide a minimum of twelve AWG 20 insulated conductors. Cable shall be West Penn 265, West Penn 283, or equal. For exterior or underground applications, provide West Penn AQ224 two conductor AWG 18 cables, or equal. Termination shall be inside the master clock and inside the PA rack only for a continuous cabling run. Label clock connections where cable terminates inside of rack.
- G. Cables between the P.A. rack and P.A. terminal cabinet for connection of switch bank positions to field circuit shall be Two-pair #22 gage, fully annealed copper wire. One twisted pair (black and red) conductors shall be shielded and the other twisted pair (green and white) shall be unshielded. Both pairs shall be under one jacket. Mohawk #1772 or West Penn CL2 #355.

2.07 TERMINAL BLOCKS AND CABINETS

- A. Terminal blocks shall be solderless push-on (#20 to 22 gage solid) with integral fanning strip. Solderless push-on type blocks shall be Siemon Company 66-Series. Terminals for connections to external circuits shall be properly labeled. 66B blocks shall be mounted directly to terminal location without use of mounting legs. 66M blocks shall be mounted on 89B mounting spacers. Install the required terminal blocks as necessary within each cabinet.

- B. Terminal blocks shall be installed on back of cabinets only, not on sides. Incoming cables shall be terminated on outside pins of terminal blocks and outgoing cables shall be terminated on second pin from buttside edge. This method shall be provided at satellite terminal locations. At main or cross-connect terminal locations incoming or outgoing cables shall be terminated on outside pins, but with jumper wires terminated on other points. Do not install grouped station cables other than 25, 50, 75 and 100 pairs of telephone cables under terminal blocks.
 - C. Auxiliary cabinets shall be securely floor or wall-mounted, in a position that will not block removable panel or swing open doors needed for normal system expansion or service. Doors shall be lockable with a door-mounted lock.
- 2.08 KEYS AND LOCKS
- A. Provide keys and locks for cabinets and equipment; locks shall be keyed to a Corbin #60 key, for access to operate equipment and Corbin #70 key, for access to service equipment.
- 2.09 PORTABLE EQUIPMENT
- A. Furnish and deliver to the OAR, one auxiliary console microphone with coiled cord and press-to-talk switch.
 - B. Portable equipment shall remain in individual boxes and be delivered to the OAR.
- 2.010 LOADS ON EQUIPMENT AND COMPONENTES
- A. Equipment and component parts shall carry continuously, without undue heating or change in rated value, loads connected thereto and rated output loads where such are specified. Equipment shall be properly fused. Components and parts shall be designed for continuous operation.
 - B. Operating voltages on capacitors shall not exceed 60 percent of their rated working voltages.
 - C. Operating wattages to be dissipated by resistors shall not exceed 25 percent of their ratings.
- PART 3 - EXECUTION AND INSTALLATION
- 3.01 INSTALLATION
- A. Install equipment as specified, as indicated on Shop Drawings, and as required. Installation shall be in accordance with manufacturers' instructions and applicable codes. Installation shall be in accordance with manufacturers' instructions and applicable codes.

- B. Systems that are re-designed with the intention to increase station or port capacity of systems shall not be accepted.
- C. Systems not installed as manufacturer instructions shall not be accepted.

3.02 RELATED SYSTEM OR SUB-COMPONENT INSTALLATION

A. Public Address system installation

1. Rack Equipment Installation: Equipment within each rack shall be logically arranged for accessibility of convenient maintenance. Equipment shall be mounted on shelves or panels and shall be securely attached. Allow 20 percent expansion in the form of empty rack units at time of occupancy. Empty rack unit spaces shall be covered with factory made plates of the same manufacture as the cabinet.
2. Amplifiers, power supplies and other heavy devices shall be mounted on steel shelves made by manufacturer of console and cabinet racks and shall be attached to cabinet by means of rack mount brackets. Heavy devices shall be mounted in the lowest practical space in the rack. Cabinet, console, and panel faces, including drawers shall be the same color. Punch blocks, screw terminals and ancillary equipment shall be installed on metal rack panels mounted on rear rails. Cables to such panels shall be dressed only from the right side of the rack, as viewed from the rear. The cable bundle must be dressed so as to allow the panel to be swung out for service.
3. Wiring within console and cabinets shall be installed to conform to standard engineering practice, and shall be terminated on terminal strips having a terminal for each required external connection. Wiring shall be cabled, laced and securely fastened in place so that no weight is imposed on any equipment, control switches, or terminals. Wires shall be contiguous between console and cabinets. Splices are permitted only at cross connect points where terminated on punch blocks.
4. Wires carrying audio power shall be shielded. Input and output circuits and terminal strips shall be installed to provide separation necessary for proper operation. Wires shall be identified by number and chart.
5. Cable charts shall be bound to rear cabinet door of PA or IC cabinet, MPATC or backboard, terminal cabinets and service manuals inside transparent plastic envelopes. The information in

these charts shall include cable's switch selector position number, designated switch bank, EZ label number from switch bank to main cross connection, EZ label number from main cross connection to end device, speaker wattage, telephone extension number, punch block locations and end device location (classroom number, office, hallway, exterior wall etc).

6. PA or IC cable terminations and connections on 66 Series blocks at terminal cabinets, backboards and MPATC shall be installed from top to bottom in office and classroom logical numerical order and shall maintain the same numbering system throughout the site. It shall follow the orderly sequence used for switchbanks room selector switches.
7. Conductor shields for each system shall be grounded at one location only. Grounding shall be provided within console and cabinet racks. There shall be no metallic connection between systems. Conduits for system and 120 volt AC system shall be bonded together at console and cabinet racks.
8. 120 volt AC supply conductors shall be terminated directly on disconnect switches specified and in a recognized raceway.
9. A minimum of 24 spare stations or ports shall be provided for system expansion capacity, even if this requires installation of a second card cage and ancillary equipment. The required equipment and connectivity shall be provided to allow for this 24 stations spare capacity regardless of the stations provided at the time of occupancy. The 24 spare stations shall be readily available for connectivity to classrooms, offices or specified location. The 24 station shall be clearly labeled and terminated on a punch block in the main public address terminal cabinet
10. A minimum of 25 spare communication cables shall be provided between the P.A. rack and the main PA terminal cabinet. 25 communications cables shall be connected to the respective telephone card, speaker card, relay module, ring module and switch bank. The 25 spare ports shall be active and ready for connectivity now or for future expansion. These 25 spare communication cables are for connection of switch bank positions to field circuits and are in addition to override, remote input, and other miscellaneous cables required for the P. A. rack.
11. At the main PA cabinet these cables, along with the other miscellaneous cables shall be neatly dressed and secured to the backboard. At the backboard they shall be routed around the

exterior of the backboard so as to assure the availability of at least six feet of spare cable, terminated, bundled, secured and routed by the most direct path.

12. At the PA rack the cable bundle shall be neatly dressed and secured to the back mounting rails of the PA rack. If the conduits enter from the top of the rack, route the bundle down the left side of the rack as viewed from the rear, across the bottom of the rack and up the right side. Cables shall be broken out from the right hand side, dressed, secured, and routed to their termination point. If cables enter from the bottom, route them up the left side, over at the top and down the right side for breakout, dress and termination.

B. Telephone interface system installation

1. Install, program and connect 4 circuits to the PABX system. Upon notification from the Contractor, the OAR shall contact the Telecommunications Branch to arrange for ordering of necessary additions to the voice system to coincide with the completion of the installation of the PA or Intercom system. Label circuits with tag at the punch block, and inside the PA rack.
2. The work provided by the Owner will encompass both hardware or software additions and any necessary programming.
3. The Telecommunications Branch will manage connections to the PBX voice system from the 66 block located under the PBX to the 110 block also located under the PBX. The contractor is responsible for the cabling, conduit, and connections from this 66 block (ports on block typically labeled by the Telecom Branch) to the main PA termination field 66 blocks.
4. Contractors working on the telecommunications system must be pre-approved by the Telecommunications Branch prior to start of construction.

C. Telephone access installation for incoming call:

1. Provide, install and connect 4 ports for High and Middle schools and 2 access ports for Elementary schools and primary Centers to allow loop start trunks from the PABX to obtain access to intercom system dialing and function capabilities. These circuits shall be used only to interface PABX to PA or IC.
2. Clearly label cabling for PBX connected telephone ports with a tag inside rack and on the punch blocks.

D. Administrative display telephones

1. Provide, program, install and connect a minimum of one administrative telephone in the Main Office, in each SLC and in each Academy.
 2. Connect the administrative telephones in sequential order starting on the first circuit of the first switch bank relay card.
 3. Wall Display Unit: Install unit in the main office unless indicated otherwise on Contract Drawings, in accordance with manufacturers instructions. For Bogen PA systems, verify and change if necessary, the ring voltage for the display tip and ring pair by moving the voltage selection shorting plug to 12v on the ringer card inside the PA rack. This associated ringer card station port is typically port number one, and shared with the main display phone (they ring together, both were designed to operate off of a 12v ring signal and act erratic if provided a 90v ring signal. (To be precise, the Bogen Multicom 2000 delivers a 60v ring signal from the ringer card, or a 12v square wave ring if the card is bypassed).
- E. Intercom instruments
1. Wall-mounted: Install where indicated modular wall plate.
 2. Desk mounted: Install and connect where indicated and specified.
- F. Special programming requirement
1. Privacy
 - a. The system shall be configured to prohibit the initiation of a two way conversation from any telephone or speaker to any speaker connected to the system without the presence of a supervisory, or privacy tone. This requirement extends to calls from the office to any classroom, from a classroom to any other classroom and from any classroom to any office. The tone shall annunciate at the initiation of the call and a minimum of every 15 seconds thereafter. The tone shall have sufficient volume to alert the occupant of a classroom with typical ambient sound that a two-way communications path has been initiated.
- G. Terminal cabinet installation
1. Lines and cables within cabinets and on main terminal backboards shall be carefully dressed with cable ties. Cables shall be formed into bundles from their emergence from conduits and shall make a 360-degree wrap around the inside of the cabinet or the exterior edge of the backboard. Cables shall be formed into a rectangular

configuration and secured to the backboard. Each cable shall be properly enumerated in numerical order with commercial wire markers and shall maintain the same number throughout the site. Wire markers shall be uniformly located within one inch of the end of the cable jacket and the numbers shall be immediately visible.

2. Conductors shall be color-coded and individual cables shall be rung out, and tagged with code markers such as W.H. Brady Co. or E-Z Code wire markers. Each cable index strip shall be typed and installed on terminal cabinet door. Each index strip shall be covered with Zellerbach # R125, or equal, typed on "as-built" drawings.
3. Terminations and connections throughout system shall be on Siemon # 66 series blocks, except at equipment that requires removal for servicing and for terminating stranded type cable. Connections to such equipment and cables shall be screw-terminal type or plug-in type. Wires connected to screw-terminal blocks shall use spade lug type terminal connectors for attachment. 110 terminating blocks shall not be accepted as a replacement for 66 series terminating blocks. Cables shall be identified as to buildings and rooms served, and terminated in terminal cabinets and backboards.
4. Cables from Telco interface blocks shall terminate on left side of 66 M1-50 blocks, with jumpers leaving from right side-bridge with Siemon Co. sneak current protector units.
5. Cables to public address system console or amplifier inputs shall terminate on 66 M1-50 blocks.
6. Cables from public address console or amplifier outputs shall terminate on 66M1-50 blocks; provide blocks for required number of switches.
7. Cables to PABX switch (trunk inputs) shall terminate on 66 M1-50 blocks, if only PABX system is included in this Contract.
8. Cables to PABX switch (extension, console, night bells, etc.) shall be terminated on 66 M1-50 blocks. Provide blocks and cables for maximum possible system configuration, if only PABX system is included in this Contract.
9. Cables to satellite terminal locations and or classrooms shall be terminated on 66 M1-50 blocks. Provide blocks as required, plus 2

vertical rows of 89B spacers for future expansion, at main cross-connect locations only.

10. Cables from auxiliary equipment shall be terminated on 66 M1-50 blocks. Provide blocks as required, plus space for a future block.
11. Feeding cables at remote cross-connect locations shall be terminated on 66 M1-50 blocks for jumpering.
12. Blocks shall be mounted in vertical rows only. Cable with lowest number shall be terminated on upper left side, with next cable in numerical order just below first cable and so on. When left side of first row of blocks is full, next cable in numerical order shall be terminated on the upper right side of first row of blocks, and so on.
13. Do not pass grouped cables in area that is to be used for jumpering. Cables shall enter blocks from top or bottom only, and shall not be in same area as jumper wires.
14. Cable distribution rings for jumper wires shall be Dracon Industries #10910-00, or equal.
15. Cable distribution rings for inside wiring cable and distribution cable shall be Dracon Industries #10941-000, 10942-000 or 1094-000, size as required.

H. Conduit

1. No more than 6 feet of flexible conduit shall be used in any conduit run.
 - a. Flexible conduit shall not be used in concealed or inaccessible areas such as interstitial wall spaces or hard lid ceilings.
 - b. Where flexible conduit is used, the conduit fill shall be derated by one trade size.
 - c. Flex shall not be used from MPATC or backboard to the PA or IC rack.
2. Pull boxes shall not be used in place of conduit bends unless site conditions do not allow the use of conduits with data sweeps. If pull boxes are proposed, it must be approved by the Owner.

3. Where not required elsewhere in District Specification or Code, pull boxes shall be sized per the BICSI TDMM current Edition, Chapter 5, Table 5.13.

3.03 OWNERS QUALITY ASSURANCE CERTIFICATIONS AND TESTING

- A. Provide instruments for testing and demonstrate, in presence of the Owner, that circuits and wiring test free of shorts and grounds.
- B. Provide test and reception gear to test for specified performance of active equipment.
- C. Furnish labor, instruments, appliances, equipment, and materials necessary to demonstrate to the Owner the installation performs as required and specified.
- D. Before Substantial Completion, submit test results and related documents to the Project Inspector.
- E. The Owner reserves the right to perform independent tests of equipment furnished, to determine whether or not equipment complies with requirements specified, and to proceed in accordance with the Contract Documents.

3.04 PROJECT RECORD DOCUMENTS

- A. As-Built Documentation
 1. Provide three copies size E (30 by 42-inch) of Project site and building plans, indicating location of equipment, conduit, cable routing, ground vaults terminal cabinets, pull boxes and other installation information.
 2. Provide three CDs of the system CPU programming and configuration.
 3. Provide two copies of the record Drawings in DWG format prepared using the most recent version of AutoCAD on a labeled CD-ROM for use on a Windows platform.
 - a. LAUSD utilizes layers as a key tool in controlling visibility of drawing elements and to provide consistent information between drawings, yet provide control over what is seen on each sheet. Public Address wiring shall be shown on a separate layer, labeled as "Public Address" that uses both building floor plans and conduit supporting structure layers below. The use of any version control blocks or company logos shall be on a layer separate from the premise wiring as-built drawings.

- b. AutoCAD files (software copies) supplied shall be multi-layer drawings with the following layers as a minimum:
 - 1) Layer one shall contain title blocks only.
 - 2) Layer two shall contain building or site plan backgrounds only.
 - 3) Layer three shall contain devices, cabling and other system components.
 - 4. Floor plans indicating devices, terminal cabinets and cross connect locations, conduit runs, ground vaults, wire types, cable routing of cables, both underground and in each building with conduit fill and count, and as-built coding used on each cable.
 - a. Drawings shall include block diagrams indicating items and their point-to-point connections in a manner following floor and site plan layout. Drawings shall also include as-built single line diagram, cable site plot plan and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on each cable.
 - b. Floor plans shall indicate devices, terminal cabinets and cross connect locations, conduit runs, ground vaults, wire types, cable routing of cables, both underground and in each building with conduit fill and count, and as-built coding used on each cable
- B. Operating and Servicing Manuals, Record Drawings:
 - 1. Deliver three copies of operating and servicing manual. Each complete manual shall be bound in three ring binders and data shall be typewritten or drafted.
 - a. Each manual shall include a page with Project site and Project name, date of Substantial Completion, Contractor name, address, telephone, and fax numbers.
 - b. Each manual shall contain a letter, signed by an officer of the company indicating the beginning and ending date of any warranties described in Article 1.07 of this section and shall describe the companies' commitment to service the warranty during the terms specified.
 - c. Each manual shall include instructions necessary for proper operation and servicing of system and shall include:
 - 1) A single line diagram of the system indicating items and their point-to-point connections in a manner following floor and site plan layout.

- 2) A complete two wire diagram of connections made between components inside the system console.
 - 3) A wiring destination schedule for each circuit leaving console and each rack.
 - 4) Custom fabricated circuits, components and connections not detailed in the manufacturer's manuals shall have wiring diagrams detailing to component level, the manner in which the circuits are connected. Provide details of input or output voltages and input or output signal levels.
 - 5) A schematic diagram of each amplifier and other components, transistor complements and replacement part numbers.
- d. Each manual shall also include as-built single line diagram, cable site plot plan and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on each cable. Drawings Size A (8 ½ by 11) and size B (11 by 17) shall be bound into the manual. Larger drawings shall be folded and inserted into transparent envelopes bound into the manual. Programming forms of each system shall be submitted with complete information.

3.05 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

- A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.07 OWNER ORIENTATION

- A. Before Substantial Completion, provide an eight hour Owner instruction period to designated Owner personnel. Contact OAR first, if assistance is needed in scheduling an appropriate time, location, or list of attendees for this training.
- B. Instruction shall be based on manufacturers written operating instructions covering those features of interest to the Owner and applicable to the Work. Instruction shall include the following:
 1. Making normal calls from intercom telephone to other intercom telephones or to the intercom administrative station. Revisit office

staff preferred method for clarity and understanding of function and methodology.

2. Answering normal calls from intercom telephones.
3. Transferring loudspeaker intercom calls from the speaker to the intercom phone.
4. Answering normal or emergency calls from the intercom administrative station.
5. Returning calls shown in the administrative station display queue.
6. Answering calls shown on the wall display from PABX phones (remote answer feature).
7. Answering calls ringing at a secondary station from admin phone or assigned intercom phone.
8. Placing calls from PABX phones to intercom station.
9. Placing calls from intercom stations to PABX phones.
10. Placing calls from intercom telephone to the public switched telephone network (PSTN).
11. Making intercom calls from PA or IC rack to classrooms.
12. Show how to set the passing bell schedules if selector switch is located on PA rack but might have been replaced by a remote selector in the main office.
13. Making an emergency all call from the rack, program all call, zone all call and individual announcement from the admin telephone and PABX telephone, and all-call from the hand held microphone located in the main office. Explain that emergency all-call from rack activates the hearing assistance system. Also explain where these hear assistance systems and the autonomous systems are located.
14. Show distribution of radio or cassette player and CD player programs. and from which web sites the instructions can be downloaded.
15. Provide copies of manufacturer user's manual to training staff and explain users' manual functions described. Provide 3 quick user's functions reference guides in a plastic laminated form. The training shall include hands on equipment.

- C. After Substantial Completion, and before contract completion, provide two additional one hour “refresher” instruction sessions at times agreed upon by the Owner.

ATTACHMENT "A"
PUBLIC ADDRESS AND INTERCOMMUNICATIONS SYSTEM
OWNERS QUALITY ASSURANCE

Site Location Code/Name _____
 Network Engineer _____ IOR _____
 PM Recommendation _____ Electrical _____

Owner is to examine the following items based on the criteria defined in sections 27 5113 (Public Address System) Owner is to examine 100 percent of rack contents. Other items not included in main rack will be tested at 10 percent rate. If deficiencies are noted, the system will be failed. Owner will consider continuing testing at a 20 percent rate to determine the integrity of the system.

PA System Check List	YES	NO	N/A	Pass/Fail
Is equipment installed as indicated in as-built?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Does workmanship installation follow industry standards, specifications and manufacturer's instructions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the UPS operational and show batteries are fully charged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
TERMINAL CABINETS AND CROSS-CONNECT TO BE INSTALLED INDOORS.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use punch blocks to terminate field cable (66 blocks). Stranded 18 ga horn cabling on screw terminals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is cabling in terminal cabinets and console neat in appearance with sufficient cable slack?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are shields grounded only at main punch block or rack end only and cross-patched at any intermediate blocks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are terminations at console and terminal cabinets, including paging and 911 lines to/from PBX labeled properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Does cable number match list posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are cables marked clearly and indelibly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are charts posted at console and terminal cabinets?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are inside and outside speakers installed as specified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify all-speaker emergency mic in main office has no feedback and radio/CD player operates.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are cables in UG (under-ground) vaults racked as specified	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

and marked outdoor rated (AQ or AQC).				
Is classroom equipment (phone, speaker and raceway) installed as specified with ringer locked at max volume?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If classroom phones are not on PBX, has the wall display in main office been installed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify physical interface with master clock and transfer switch of first relay to either PA system for all-speaker tone.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify physical connection and labeling of PBX to PA/IC.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Contractor to provide the system program downloadable to laptop or disk and examine.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Main System Functionality	YES	NO	N/A	Pass/Fail
Verify all call with microphone, pbx phone and class tones. Check for clarity and sound level in the following areas:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Perimeter areas farthest away from system. Verify no horns are facing off campus. If found, tap down or disable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
In a sample of classrooms verify that steady class tone and all-calls are not too loud in classrooms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do gyms and auditoriums have equipment (speakers and phones) attached to main PA.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify emergency all call with microphone and PBX phone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify each group all call (zone paging) with PBX phone.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify every speaker connection by making main office intercom call to each speaker or horn.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify volume controls are working.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify acceptable level of loudness and clarity for outside, inside, and hallway speakers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Manually test passing tones, verify specific tones for gyms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are automatic PA system tones defeated when the Fire Alarm system is in alarm? (first fire alarm relay)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are manual tones from the main PA console defeated when the Fire Alarm system is in alarm? (also first relay)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are loudspeaker audio sources defeated when the Fire Alarm system is in alarm? (second fire alarm relay)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Intercommunication Systems	YES	NO	N/A	Pass/Fail

Does classroom phone have dial tone when picked up?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Make call to main office, and check for clarity and sound level and verify that the person can hear you. Repeat 4 to 8 times depending on the number of PBX interconnection lines.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Receive call from main office, and check for clarity and sound levels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Receive room PA announcement and passing tone from main office, checking for clarity and sound level in both instances.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify code to access the PBX and make the connection to a station. Repeat for a total of four times to test lines.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify emergency alert to main office(30 second off-hook, dialing **, or triple-hook flash).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify hands-free, two-way communication between main office and speaker. Check for clarity and sound level.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Demonstrate that the supervisory tone is present during calls placed from PBX, System administrative and Intercom staff phones to any speaker on the system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PBX System	YES	NO	N/A	Pass/Fail
Verify PBX station transfer to IC system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify all-call paging from PBX. Test both EL or four HS/MS paging lines in sequence by hanging up and repeating the all call page.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify true 911 access from all classrooms by sample testing only one or more rooms. Contact with 911 operator shall not require dialing any extra digits (9-911) unless approved by the ITD Telecommunications Department.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

END OF SECTION